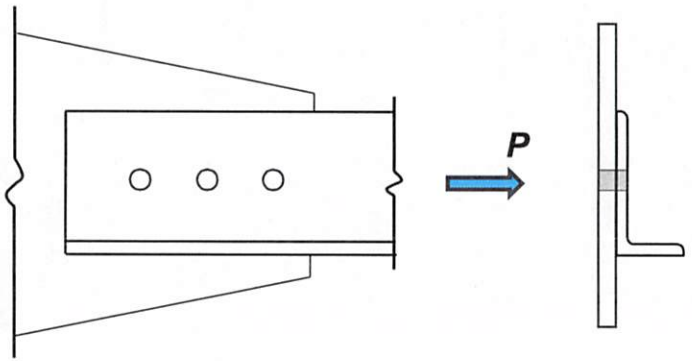
Classroom Problem 3.6-1: Use ***LRFD*** to select a tension member for a roof truss of **A572** Grade 50 steel (F_y = 50 *ksi*, F_u = 65 *ksi*). The axial dead load is 60 *k*, the live load is 6 *k*, and the member is 12 ft. long. Assume ⅞-in.-diameter bolts located on a single gage line.



$$P_U = 1.2D + 1.6L = 1.2(60^k) + 1.6(6^k) = 81.6^k$$

$$P_U = 1.4D = 1.4(60^k) = 84^k \ *$$

$$d_{Hole} = d_b + \tfrac{1}{8}\,in = \tfrac{7}{8}\,in + \tfrac{1}{8}\,in = 1\,in$$

$$\text{REQUIRED } A_g = \frac{P_U}{\phi F_y} = \frac{84^k}{0.90(50ksi)} = 1.8667\,in^2$$

$$\text{REQUIRED } A_e = \frac{P_U}{\phi F_U} = \frac{84^k}{0.75(65ksi)} = 1.7231\,in^2$$

* ASSUME $U = 0.80$
CASE 8 TABLE D3.1

$$\text{REQUIRED } A_n = \frac{A_e}{U} = \frac{1.7231\,in^2}{0.8} = 2.1538\,in^2$$

$$r_{min} = \frac{L}{300} = \frac{12\,ft\,(12\,in/ft)}{300} = 0.48\,in$$

$A_n + A_{HOLE}$

STANDARD THICKNESS	A_{HOLES} (in^2)	REQ. A_g (in^2)	TABLE 1-7 ANGLE
1/4 in	(1in) 1/4 in	2.4038	NO ANGLES
* 5/16 in	(1in) 5/16 in	2.4663	L5x3½x5/16 $A_g = 2.56 in^2$ r=0.76
3/8 in	(1in) 3/8 in	2.5288	L4x3½x3/8 $A_g = 2.68 in^2$ r=0.719
7/16 in	(1in) 7/16 in	2.5913	L3½x3x7/16 $A_g = 2.67 in^2$ r=0.62
½ in	(1in) ½ in	2.6538	L3x3x½ $A_g = 2.76 in^2$ r=0.58

USE L5x3½x5/16